

REMARKS

Claims 1 through 5, 7 through 32, and 58 through 64 are currently pending in the application.

Claims 33 through 57 are withdrawn from consideration as being directed to a non-elected invention.

Claims 1 through 5, 7 through 32, and 58 through 64 stand rejected.

Information Disclosure Statement(s)

Applicant notes the filing of an Information Disclosure Statement herein on April 5, 2004, and notes that no copy of the PTO/SB/08 was returned with the outstanding Office Action. Applicant respectfully requests that the information cited on the PTO/SB/08 (which is the same as that of record to that date in the parent application hereto) be made of record herein.

35 U.S.C. § 112 Claim Rejections

Claims 1 through 5, and 7 through 32, stand rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Applicants respectfully traverse this rejection, as hereinafter set forth.

Applicant has amended the claims to clearly comply with the provisions of 35 U.S.C. § 112.

Claim 64 stands rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Applicants respectfully traverse this rejection, as hereinafter set forth.

Applicant has amended the claim to clearly comply with the provisions of 35 U.S.C. § 112.

35 U.S.C. § 103(a) Obviousness Rejections

Obviousness Rejection Based on U.S. Patent 6,074,895 to Dery et al.

Claim 64 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Dery et al. (U.S. Patent 6,074,895). Applicant respectfully traverses this rejection, as hereinafter set forth.

Applicant asserts that M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, **the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). (Emphasis added).

Turing to the cited prior art, Dery et al. teaches or suggests a method of forming a flip-chip assembly. A flip-chip 110 with a passivation layer 111 of polyimide or other material is attached to a chip carrier 120 which may have an epoxy resin solder mask surface 124 with inorganic filler particles. A gaseous plasma is used to treat the chip 110 to oxidize and micro-roughen the surface of the passivation layer 111. The surface 124 of chip carrier 120 may also be roughened by the gaseous plasma or by mechanical means. An encapsulant material 140 is used to underfill the space between the flip-chip 110 and chip carrier 120. The plasma treatment is believed to enhance adhesion between the filler and the chip surface and the chip carrier.

Dery et al does not teach or suggest the claim limitation of presently amended independent claim 64 calling for "applying a wetting agent layer having a thickness of about a monolayer to one of said surface of said semiconductor device and said surface of said substrate" to establish a *prima facie* case of obviousness under 35 U.S.C. § 103 regarding the claimed invention. Applicant asserts that the application of a gaseous plasma to the surface 111 of the substrate 120 of Dery et al. does not teach the claim limitation of a wetting agent layer having a thickness of about a monolayer.

Therefore, Applicant asserts that presently amended independent claim 64 is allowable.

Obviousness Rejection Based on U.S. Patent 6,074,895 to Dery et al. and U.S. Patent 4,231,910 to Plueddemann

Claims 1 through 5, 7 through 12, 15, 22, and 58 through 64 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Dery et al. (U.S. Patent 6,074,895) and Plueddemann (U.S. Patent 4,231,910). Applicant respectfully traverses this rejection, as hereinafter set forth.

Applicant again asserts that M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, **the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). (Emphasis added).

Again turning to the cited prior art, Dery et al. teaches or suggests a method of forming a flip-chip assembly. A flip-chip 110 with a passivation layer 111 of polyimide or other material is attached to a chip carrier 120 which may have an epoxy resin solder mask surface 124 with inorganic filler particles. A gaseous plasma is used to treat the chip 110 to oxidize and micro-roughen the surface of the passivation layer 111. The surface 124 of chip carrier 120 may also be roughened by the gaseous plasma or by mechanical means. An encapsulant material 140 is used to underfill the space between the flip-chip 110 and chip carrier 120. The plasma treatment is believed to enhance adhesion between the filler and the chip surface and the chip carrier.

Plueddemann teaches or suggests a primer composition for improving adhesion between a solid substrate and a thermo-plastic resin. The composition consists essentially of 1 to 25 weight percent of an organosilicon compound selected from a group of silane compounds or partial hydrolyzates thereof and 75 to 99 weight percent of an alkoxyethyltriazine. Plueddemann teaches an improved wet and dry adhesion of thermoplastics to solid substrates. The primer compound of Plueddemann is not directed to an improved flow of an underfill material.

Applicant asserts that any combination of Dery et al. and Plueddemann does not and cannot establish a *prima facie* case of obviousness under 35 U.S.C. § 103 regarding the presently claimed inventions of presently amended independent claims 1, 10, 58, 62, and 64 because, at the least, there is no teaching or suggestion in the cited prior art that teaches or suggests all the claim limitations. Applicant asserts that no combination of Dery and Pluedemann teaches or suggests the claim limitations of such claims calling for “applying a liquid wetting agent layer to one of said surface of said semiconductor device and said surface of said substrate”, “applying a liquid wetting agent layer to one of said active surface of said semiconductor device and said upper surface of said substrate”, “applying a silane-based material layer to one of a portion of said active surface of said semiconductor device and a portion of said upper surface of said substrate”, and “applying a wetting agent layer having a thickness of about a monolayer to one of said surface of said semiconductor device and said surface of said substrate”.

Dery et al. uses a gaseous plasma to roughen the surface 111 of the substrate 120 while Pluedemann uses primer composition for improving adhesion between a solid substrate and a thermo-plastic resin. Applicant asserts that such teachings or suggestions when combined do not teach or suggest the above claim limitations in an underfill process.

Therefore, claims 1 through 5, 7 through 12, 15, 22, and 58 through 64 are allowable.

Obviousness Rejection Based on U.S. Patent 6,074,895 to Dery et al. and U.S. Patent 4,231,910 to Plueddemann, and Further in Combination with U.S. Patent 5,766,982 to Akram et al.

Claims 13, 14, 16 through 21, and 23 through 30 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Dery et al. (U.S. Patent 6,074,895) and Plueddemann (U.S. Patent 4,231,910), and further in combination with Akram et al. (U.S. Patent 5,766,982). Applicant respectfully traverses this rejection, as hereinafter set forth.

Again, Applicant asserts that that M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must

be a reasonable expectation of success. Finally, **the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). (Emphasis added).

Again turning to the cited prior art, Dery et al. teaches or suggests a method of forming a flip-chip assembly. A flip-chip 110 with a passivation layer 111 of polyimide or other material is attached to a chip carrier 120 which may have an epoxy resin solder mask surface 124 with inorganic filler particles. A gaseous plasma is used to treat the chip 110 to oxidize and micro-roughen the surface of the passivation layer 111. The surface 124 of chip carrier 120 may also be roughened by the gaseous plasma or by mechanical means. An encapsulant material 140 is used to underfill the space between the flip-chip 110 and chip carrier 120. The plasma treatment is believed to enhance adhesion between the filler and the chip surface and the chip carrier.

Plueddemann teaches or suggests a primer composition for improving adhesion between a solid substrate and a thermo-plastic resin. The composition consists essentially of 1 to 25 weight percent of an organosilicon compound selected from a group of silane compounds or partial hydrolyzates thereof and 75 to 99 weight percent of an alkoxyethyltriazine. Plueddemann teaches an improved wet and dry adhesion of thermoplastics to solid substrates. The primer compound of Plueddemann is not directed to an improved flow of an underfill material.

Akram teaches or suggests mechanical applications of underfill material through a centrally located opening, tilting the substrate and chip assembly to use gravitational forces and vibrating the substrate and chip assembly to enhance the flow of underfill material and capillary action during the underfill process.

Applicant asserts that any combination of Dery et al. Plueddemann, and Akram does not and cannot establish a *prima facie* case of obviousness under 35 U.S.C. § 103 regarding the presently claimed inventions of presently amended independent claim 10 as well as dependent claims 13, 14, 16 through 21, and 23 through 30 because, at the least, there is no teaching or suggestion in the cited prior art that teaches or suggests all the claim limitations. Applicant asserts that no combination of Dery et al., Plueddemann, and Akram teaches or suggests a claim

limitation of such claims calling for “applying a liquid wetting agent layer to one of said surface of said semiconductor device and said surface of said substrate”.

Dery et al. uses a gaseous plasma to roughen the surface 111 of the substrate 120 while Pluedemann uses primer composition for improving adhesion between a solid substrate and a thermo-plastic resin and Akram uses nothing but gravity. Applicant asserts that such teachings or suggestions when combined do not teach or suggest the above claim limitations in an underfill process.

Therefore, presently amended independent claim 10 and dependent claims 13, 14, 16 through 21, and 23 through 30 therefrom are allowable.

Obviousness Rejection Based on U.S. Patent 6,074,895 to Dery et al. and U.S. Patent 4,231,910 to Plueddemann, and Further in Combination with U.S. Patent 5,203,076 to Banerji

Claims 31 and 32 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Dery et al. (U.S. Patent 6,074,895) and Plueddemann (U.S. Patent 4,231,910), and further in combination with Banerji (U.S. Patent 5,203,076). Applicant respectfully traverses this rejection, as hereinafter set forth.

Again, Applicant asserts that that M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, **the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). (Emphasis added).

Again turning to the cited prior art, Dery et al. teaches or suggests a method of forming a flip-chip assembly. A flip-chip 110 with a passivation layer 111 of polyimide or other material is attached to a chip carrier 120 which may have an epoxy resin solder mask surface 124 with inorganic filler particles. A gaseous plasma is used to treat the chip 110 to oxidize and micro-

roughen the surface of the passivation layer 111. The surface 124 of chip carrier 120 may also be roughened by the gaseous plasma or by mechanical means. An encapsulant material 140 is used to underfill the space between the flip-chip 110 and chip carrier 120. The plasma treatment is believed to enhance adhesion between the filler and the chip surface and the chip carrier.

Pluedemann teaches or suggests a primer composition for improving adhesion between a solid substrate and a thermo-plastic resin. The composition consists essentially of 1 to 25 weight percent of an organosilicon compound selected from a group of silane compounds or partial hydrolyzates thereof and 75 to 99 weight percent of an alkoxyethyltriazine. Pluedemann teaches an improved wet and dry adhesion of thermoplastics to solid substrates. The primer compound of Pluedemann is not directed to an improved flow of an underfill material.

Banerji teaches or suggests mechanical applications of a vacuum, using the force of air to force underfill material between a substrate and chip while heating the assembly using a hot plate.

Applicant asserts that any combination of Dery et al. Pluedemann, and Banerji does not and cannot establish a *prima facie* case of obviousness under 35 U.S.C. § 103 regarding the presently claimed inventions of presently amended independent claim 10 as well as dependent claims 31 and 32 because, at the least, there is no teaching or suggestion in the cited prior art that teaches or suggests all the claim limitations. Applicant asserts that no combination of Dery et al., Pluedemann, and Banerji teaches or suggests a claim limitation of such claims calling for “applying a liquid wetting agent layer to one of said surface of said semiconductor device and said surface of said substrate”.

Dery et al. uses a gaseous plasma to roughen the surface 111 of the substrate 120 while Pluedemann uses primer composition for improving adhesion between a solid substrate and a thermo-plastic resin and Banerji uses nothing but a vacuum and air pressure or force and a hot plate. Applicant asserts that such teachings or suggestions when combined do not teach or suggest the above claim limitations in an underfill process.

Therefore, presently amended independent claim 10 and dependent claims 31 and 32 therefrom are allowable.

Applicant requests entry of this amendment for the following reasons:

The amendment is timely filed.

The amendment places the application in condition for allowance.

The amendment does not require any further search or consideration.

In summary, Applicant submits that claims 1 through 5, 7 through 32 and 58 through 63 are clearly allowable over the cited prior art for the reasons set forth herein.

Applicant requests the entry of this amendment, the allowance of claims 1 through 5, 7 through 32 and 58 through 63, and the case passed for issue.

Respectfully submitted,



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